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Unhealthiness of Towns: its Causes and Remedies.

ON THE

SANITARY CONDITION

OF

NEWCASTLE-ON-TYNE,

AND THE MEANS NECESSARY FOR ITS IMPROVEMENT;

BEING A

LECTURE

DELIVERED BEFORE

THE LITERARY AND PHILOSOPHICAL SOCIETY

OF THAT TOWN,

ON THE 10TH OF FEBRUARY, 1847,

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A LECTURE,

8c., 8c.,

GENTLEMEN,

I SHOULD not have ventured thus to obtrude myself upon your notice, were I not supported by a firm conviction of the importance of the cause which has drawn us together this evening, and of the urgent necessity for that cause being at once pressed upon the attention of the inhabitants of this large and flourishing town. There are, indeed, now in operation, some circumstances which render the sanitary condition of Newcastle a question of more than ordinary interest. In the first place, the epidemic diseases which have committed such fearful ravages during the past year, causing the proportion of deaths to be as high as 1 to every 25 inhabitants of the town, are still haunting certain districts with undiminished virulence. An inquiry into the causes which either give rise to, or predispose to the occurrence of, these scourges of mankind, with a view to their prevention, is, therefore, at the present moment, particularly demanded. And as the clearances now being effected by the railway companies must

have the effect of driving a large proportion of the labouring population into new dwellings, it becomes highly desirable that advantage be taken of this opportunity to prevent, as far as possible, their relapse into those habits of uncleanness which are rather forced upon them by the utter absence of all public sanitary arrangements, than the results of their own natural disposition.

But in addition to these two local inducements to exertion in this cause, there are one or two other considerations of general interest which may tend to excuse the step I have taken in calling your attention to the subject. In her opening speech to Parliament, the Queen has intimated the probability of a bill being introduced for the improvement of the health of towns. And as the measure about to be brought forward by the present Government is based upon the recommendations of a commission appointed by the late ministry, and therefore certain of the support of the leading men of both parties, as well as of that large and happily increasing number of philanthropists who, on questions of this nature, belong to no party, its rapid passage into a law may be fairly anticipated. Is it not well, therefore, for the public mind to be prepared for the working of such a measure by being put in possession of some of the facts and principles upon which this bill is founded, and so made acquainted with the nature and consequences of the evils which it is intended to obviate? The only other point which I shall urge in justification of this attempt to arouse your

interest in the question of sanitary reform, is that half-anticipation of the dreadful possibility of the cholera revisiting this country, which is now beginning to fasten itself upon the minds of many thoughtful and observing men. And if there be a prospect of the recurrence of such an infliction, no matter how remote the danger may at present appear,* every dictate of prudence and of humanity must surely enjoin the observance of all those precautions which may have the effect of arresting the progress, or mitigating the severity, of the threatened attack.

In connection with this point, I cannot do better than read a short extract from a note which I lately received on this subject from Mr. Chadwick, a gentleman long distinguished for the zeal and ability with which he has investigated the various circumstances injuriously affecting the poor of this Kingdom, and which as expressing the opinion of an experienced observer with reference to the condition of this town is peculiarly valuable. He says, "from what I remember to have seen in a short inspection of Newcastle on Tyne, the selected place for the entrance of the cholera, in no town is the *completeness* of measures more essential to its sanitary improvement."

Having thus glanced at some of the considera-

* By the last accounts, the cholera had committed dreadful ravages at Mecca, destroying 15,000 persons, and was daily expected to show itself at Suez, Cairo, and other places on the overland route.

tions which are calculated to recommend to your attention what might otherwise have appeared a tedious and uninteresting subject, I shall now proceed to state briefly the physical conditions which the science of Life shews to be necessary for the preservation of the health of man, and then examine how far the circumstances under which the inhabitants of this town are placed, depart from, and are opposed to, these essential conditions.

For the preservation of the life of man the performance of three great functions is necessary, and these functions are intended to accomplish 1. The formation of the blood. 2. The motion of the blood. 3. The purification of the blood.

If the formation of the blood be arrested, either by a defective supply of food, or by the inability to digest that food, or by any circumstance impeding the passage of the prepared aliment into the veins, the whole body soon emaciates, its vitality becomes rapidly diminished, and death results. If again from any cause, the action of the heart, and its effect—the motion of the blood—be even for a minute suspended, life also ceases. And, lastly, if respiration, the chief action employed for the purification of the blood, be rendered useless by depriving a human being of a constant supply of fresh air, animal life is almost instantly extinguished beneath the destructive influence of the poisons generated within the body itself. The same fatal effect, it may be added, is with equal certainty, though more slowly, induced through the insidious operations of disease,

when these Vital Actions become impaired in consequence of the body being exposed to less active, but long continued, causes of disorder. And the maintenance of these functions in a healthy and natural state, by preserving them from the disturbing influence of any external noxious agencies, constitutes the great object of the art of preventive medicine.

We shall, perhaps, arrive most easily at the discovery of the evils peculiarly afflicting the poorer inhabitants of large towns like this, if we for a moment consider the physical circumstances which science and the common experience of mankind shew to be absolutely requisite for the preservation of health. They may be thus enumerated—1. Exposure to Solar light. 2. An unintermitting supply of pure atmospheric air. 3. A plentiful provision of water, both as an article of diet and for purposes of cleanliness. 4. Regular exercise in the open air. 5. An adequate quantity of wholesome food. A certain moderate temperature is also required for the purposes of Life; but as the supply of fuel is a point which does not call for legislative interference, varying with the geological formation and vegetable resources of each district, we need not, on the present occasion, further allude to it.

In pursuance of the investigation it will be advantageous to glance in the first instance at the mode of operation of each of these essential conditions, and then proceed to inquire how far they are accessible to the great mass of the inhabitants of

this town. It will also be necessary to indicate at the same time the physical disorders which result from the various deprivations and impurities consequent on the present absence of public sanitary arrangements. The moral, social, and intellectual evils which flow from the same prolific source of demoralization, degradation, and disease, may be more conveniently examined in a subsequent part of the lecture.

Modern researches into every department of animated nature have demonstrated the existence of an intimate connection between the presence of *Solar Light* and the performance of some of the higher functions of plants and animals. If, for instance, plants be kept in a dark place, it is found that their leaves soon lose their natural green colour, that the secretion of their peculiar products is either totally arrested or materially impaired, and, in short, that their vitality is perceptibly diminished. This affection of plants is described in botanical works under the term etiolation, and a similar degeneracy or deterioration of the vital powers also occurs in animals subjected to a similar deprivation. The body, if young, ceases to be fully developed, the individual remains stunted in growth and frequently enfeebled in mind, less apt than others to resist the attacks of disease, and more prone to those perversions or disorders of the process of developement which induce idiotcy and deformity. In confirmation of this statement it may be necessary to mention one or two facts, and I cannot adduce more striking cases

than some of those detailed in the evidence given before the Health of Towns Commission. Some cellars under the fortifications of Lille were inhabited by several poor families, but the number of deformed and idiotic children born there, soon became so remarkable, that the authorities caused these subterranean abodes to be filled up. Sir James Wyllie, a physician in the Russian service, states that the cases of disease on the dark side of an extensive barrack at St. Petersburg have been uniformly, for many years, in the proportion of three to one to those on the side exposed to strong light. And the observations of Dr. Milne Edwards detailed in his work "On the influence of physical agents upon life," illustrate, in a most remarkable manner, the connection existing between Solar Light and the actions of Vitality. It is generally known that the frog, prior to its appearance as a reptile, exists as a fish, constituting the innumerable tadpoles which are found in ditches and ponds during the spring. The difference in form, habits, and functions between the perfect and immature animal is therefore very great, and the observation of the successive changes by which its transition is effected, must obviously constitute a favourite study with naturalists. Dr. Edwards then, having preserved some of these tadpoles in a dark place, but otherwise supplied with everything necessary for their growth and developement, found as the result of numerous experiments, that though the nutrition of the animals was evidently complete, inasmuch as they in-

creased in size, yet that formation of limbs which ordinarily prepares the inhabitant of the water for its amphibious existence did not take place, and that the endowment of the tadpole with the higher functions necessary for the formation of a more perfect animal was completely prevented. And we do not find that the human body is less dependent upon light for the perfect performance of its functions. For in accordance with the facts above mentioned, the same Dr. Edwards observes that "persons who live in caves and cellars, or in very dark or narrow streets, are apt to produce deformed children; and that men who work in mines are liable to disease and deformity beyond what the simple closeness of the air would be likely to produce." In corroboration of this testimony we have but to look around us and notice the large proportion of deformed and sickly children which abound in the dark courts and lanes of this or any other large town. The extensive prevalence, in the deep and gloomy vallies of the Alps, of the horrible disease termed Cretinism, a combination of scrofula with idiotcy, may also here be referred to as exhibiting on a large scale the melancholy condition to which human beings may be reduced under the joint influence of darkness and atmospheric impurity. And are not thousands of the poorer inhabitants of our large towns at this moment exposed to the same causes of intellectual and physical prostration in a degree scarcely less intense and unintermitting?

In Liverpool alone, as many as 40,000 human

beings live in cellars or caves wholly inaccessible to the purifying and vitalizing influence of the solar rays. And though in this town, from its situation on a declivity, there may be few persons actually dwelling in subterranean abodes, yet the physical conditions affecting the inhabitants of the dark and crowded lanes leading out of all the great thoroughfares are precisely similar to those, which, in the sunless and stagnant atmosphere of the Swiss valleys, produce such lamentable consequences. We do not, unfortunately, possess the means of measuring with ease, or of expressing by figures, the intensity of light in any given place. I must, therefore attempt to convey some idea of the quantity present in the residences of the poor by using familiar illustrations. On entering many of these houses the visitor is at once arrested in his progress by finding himself in perfect darkness,* so much so, that in the middle of a bright clear day, he is compelled to trust solely to the sense of touch in endeavouring to reach the staircase. And having surmounted this difficulty, and made his way into the apartments occupied by the different families in the house, he will, in the majority of instances, find himself unable to read any common print, at a distance of more than two feet from the window. Throughout the rest of the room, comprising the warmer and more comfortable part, where the business of the family generally proceeds, a dim twilight

* See Appendix, Note 1.

constitutes the feeble representative of the glorious day without. And when it is considered that in many of these courts, the space between the opposite houses is little more than four feet, and that not unfrequently, particularly in the chares or lanes leading out of Pandon and the Quay, they are overshadowed by huge warehouses, this statement will perhaps be rendered more intelligible to persons unacquainted with these localities. Even in this town, then, notwithstanding all the improvements which it has undergone, and the generally flourishing condition of its manufactories, hundreds, I may say thousands, of our fellow creatures spend nearly the whole of their lives in comparative darkness, subjected from their very birth to the noxious influence of a powerful predisposing cause of disease, and through the operation of an odious and impolitic law, deprived of that 'holy light' which science and the instinctive feelings of our nature equally declare to be indispensable to the enjoyment and preservation of health.

"Seasons return : but not to *them* returns
 Day, or the sweet approach of even or morn,
 Or sight of venal bloom, or summer's rose,
 Or flocks, or herds, or nature's face divine ;
 But cloud instead, and ever-during dark
 Surrounds *them*, from the cheerful ways of men
 Cut off, and for the book of knowledge fair,
 Presented with a universal blank
 Of nature's works to *them* expunged and rased
 And wisdom at one entrance quite shut out."

And as regards those possessed of the power to

mitigate and remove this evil, may we not, continuing the quotation, join in the beautiful aspiration of the poet—

“So much the rather thou, celestial light,
Shine inward, and the mind through all her powers
Irradiate”

We have now to examine how far the next great essential to the preservation of health, a constant supply of pure air, is afforded to the inhabitants of large towns generally, and to those of this town in particular. And as tending to facilitate this branch of the enquiry, it may be well here to present a brief sketch of the nature and uses of the respiratory process. The alternate passage of air into, and out of, the air tubes of the lungs, which constitutes the act of respiration, corresponds with the two great uses of those organs, namely:—first, the purification of the blood by the extrication and expulsion into the atmosphere of certain poisonous substances formed during its circulation through the rest of the body; and secondly—the preservation of the animal temperature and conversion of the nutriment into blood, by the absorption into that fluid of oxygenated air. There is therefore during health a constant interchange of gaseous substances between the blood and the atmosphere, the latter receiving from the former carbonic acid and various noxious effluvia, whilst it is at the same time deprived of a large proportion of its oxygen by the innumerable streams of blood which incessantly traverse every part of the lungs,

and from which it is separated merely by two extremely thin porous membranes. As regards the precise mode in which, or the physical agencies by means of which, this beneficial interchange is effected, physiologists are not quite agreed in opinion: two great facts are however indisputable, having been proved by repeated observations and experiments, namely:—first, that the blood does constantly exhale into the air through the lungs certain poisonous vapours from the retention of which, within the body, death speedily and certainly results; and secondly—that the streams of blood which surround the extremities of the air tubes do possess the power of absorbing, with inconceivable rapidity, any gases or liquids which may be present in those tubes. And it is upon a knowledge of these two facts that we must rest all our efforts to prevent disease, by the removal of circumstances calculated to induce disorder or perversion of the respiratory functions. Before entering upon the consideration of the more subtle and invisible agents which thus insidiously sap the foundations of life, it is necessary to allude to a mechanical source of impurity met with in the atmosphere of large, and especially of manufacturing towns. And perhaps in no part of the kingdom is more inconvenience and discomfort experienced from the smoke nuisance, than in this town. Considered merely in an economical point of view, the prevention as far as practicable of that copious diffusion of soot and coal dust which we daily breathe is an object of the greatest importance. Thus the Rev. Mr.

Clay in his report on Preston (a town containing very nearly the same population as Newcastle) calculates that by the general employment in factories of even the present imperfect plans for the consumption of smoke, "an annual saving in the washing of clothing, &c., would take place to the extent of 1*d.* per head, per week, that is of £208. 17*s.* per week, or £10,450. 4*s.* per year." In this estimate he is supported by other gentlemen who have studied the subject, and a slight examination of the gross amount annually expended in washing by the inhabitants of any large town, will satisfy every unprejudiced person that the saving of even this enormous sum is by no means impossible. Another item of expense materially augmented by the same nuisance, is the more frequent painting of shops and houses which it necessitates. And hence Mr. Clay calculates that by the general introduction into factories of smoke consuming contrivances, one-fourth of this expense, amounting in a town of the size of Preston, to £1250., might be annually saved. The garden ground in the neighbourhood of towns would also be rendered much more productive. A striking illustration of this point was presented during the prevalence of the plague in London, when the town being comparatively emptied and the quantity of smoke thus considerable reduced, trees which before scarcely ever blossomed, at once regained their vitality and exhibited plentiful crops of fruit. It moreover fortunately happens in this as in every other question of sanitary reform, that the improvements demanded

for the benefit of the public are, when rightly understood and traced to their ultimate consequences, also productive of pecuniary advantage to each individual member of the community. For instance Mr. Wm. Elsworth an experienced engineer superintending two factories in Preston, is represented by Mr. Clay as stating, "that the adoption of Parke's plan in fitting up the boiler, &c., does not involve an additional expense of more than £5. The saving in coal, as tested by more than 20 years' experience, is 7 per cent.: two tons of coal produce only four pounds of ashes; and during eight hours out of the twelve, the smoke is perfectly consumed." And we are informed that other still more advantageous methods are now before the public.

Turning then, for the present, from the economical to the sanitary bearings of this subject, let us for a moment consider the injurious consequences likely to result to sensitive and vascular organs, such as the lungs, from the constant presence of a large quantity of smoke in the air respired. Now even assuming smoke to possess no acrid particles (though it most undoubtedly does contain such) we can prove, both by analogy and actual observation, that the inspiration of air thus charged with minute atoms of carbon and coal-dust, tends to produce the most serious forms of pulmonary disease. Thus the fork grinders of Sheffield, a class of men whose occupation, as at present pursued, compels them to breathe air containing the fine dust caused by the attrition of metals against revolving sand-

stones, for the most part die under 30 years of age, and on examination after death, their lungs are found to have been inflamed and converted into a putrid mass, by the irritation consequent on the accumulation of these metallic and earthy particles in the smaller air tubes. And in our own district the lungs of pitmen very frequently present a dirty, ash grey, instead of the natural pink colour, and this morbid appearance (which is generally associated with the prevalence, during life, of cough or some other indication of disordered respiration) can only be ascribed to the deposit in the pulmonary air tubes of the fine dust suspended in the atmosphere which they breathe. In every point of view, therefore, the mitigation of this evil by enforcing, if need be, on manufacturers the employment of the cheap and available contrivances invented for the purpose, seems to be urgently called for. But as a body of gentlemen have for some time organized a Smoke Prevention Committee in Newcastle, (chiefly at the instigation of our esteemed townsman, Mr. Greenhow,) and as an act for remedying this nuisance will come into operation during the ensuing summer, any further observations on this head are not required.

Passing on then to the consideration of the other circumstances which tend directly or indirectly to vitiate the quality of the air respired, we shall find that they all operate, either by preventing the passage into the atmosphere of the noxious vapours extricated from the blood, or by presenting to the

absorbing blood vessels of the lungs, and so introducing into the body, a variety of poisonous substances. The chief *indirect* cause of vitiated respiration is an imperfect supply of fresh air. We see that Nature has by an instinctive and incessant motion of the chest ensured a constant renewal of the air contained within the branches of the windpipe. And if man still adhered to his primitive habits, if we were all hunters and shepherds as of yore, there would be no need for any further contrivance. But, doubtless for wise ends, it happens that as we advance in the scale of civilization not only do a number of artificial wants arise, but the difficulty of ministering to our prime necessities is so much increased as to demand for their supply an unwearied exercise of our utmost intelligence and energy. Nor is there one among the many questions thus forced upon the attention of every civilized community, which is in itself so important, or the correct solution of which is so indispensable to the preservation of health, as the investigation of the best and simplest means for providing, in every space occupied by human beings, a gradual, but constant, change of air.

Innumerable are the catastrophes, some of sufficient magnitude to occupy the page of history, which testify to the necessity for man carrying out in his dwellings the same principle upon which nature has proceeded in the fabrication and endowment of his body. She has, by a simple but efficacious process, provided for the ventilation of his lungs, and it is

for him, using the reason with which he is blessed, and imitating the beneficent provisions indicated by science, to direct through every place which he inhabits a gentle current of that invisible atmosphere which was intended to be a source of life, but which has hitherto been too frequently a transmitter of disease and death.

In a general survey of the extensive subject of sanitary reform it is of course impossible to illustrate at any length, the principles of the art of ventilation, I shall therefore content myself with adducing some proofs of the extreme inattention to this vital point which prevails among the different classes of society, and then briefly explain the manner in which a local stagnation of the atmosphere operates in the production of disease.

The causes of imperfect ventilation in large towns are,—1, the existence of numerous blind courts; narrow lanes closed at one end, so that the passage of a current of air through them is a physical impossibility. And I need scarcely say that scores of such courts exist within the precincts of this town, many leading out of the most fashionable streets.

The 2nd great cause of imperfect ventilation is over crowding, or, in other words, the existence of a disproportion between the size of a house or room, and the number of its inhabitants. Physiology fortunately enables us to ascertain with tolerable accuracy the quantity of air necessary for the proper performance of the function of respiration. The generality of individuals take into the lungs at each inspiration

about 20 cubic inches of air, and there being 20 respirations per minute, 400 cubic inches of air enter in that time. On these data it has been calculated that each individual in the course of the night vitiates about 300 cubic feet of air, rendering it quite unfit for respiration. Now Dr. Duncan has by actual measurement of some of the lodging houses in Liverpool, ascertained that the quantity of air supplied to their inmates does not amount to one-fourth of the minimum necessary for the purposes of health. The Rev. Mr. Clay states, that taking an average of numbers, and of age, the deaths in the town of Preston, during a period of five years, were 17 times more numerous than within the walls of the prison—a difference which he chiefly attributes to over crowding. And when we find it mentioned that “in the new prison at Pentonville from 30 to 45 cubic feet of pure fresh air are made to pass into every cell in a minute;” and “that the Inspectors of Prisons in England recommend not less than 1000 cubic feet for every prisoner, as being essential to health and ventilation,” this balance of health in favour of the criminal, as compared with the poorer inhabitants of our towns, is no longer surprising. This evil prevails in Newcastle to as great an extent as in other towns. Dr. Reid, in his local report, speaks of “entering one of these lodging-houses crowded with beds;” and “noticed at Gateshead five beds in one room, in each of which there were from one to three persons unwell.” Such hot beds of disease are very common in Sandgate, in the

neighbourhood of the Castle, and in the courts leading out of Newgate Street; and Dr. Reid may well observe "that many individuals thus become a burden to parishes, who might otherwise have escaped with impunity." These lodging-houses have naturally attracted most notice, because the over crowding is there carried to its greatest extent; but wherever families, each comprising 6 or 8 persons, are compelled to live in one room, similar evils must also inevitably result.

The only other causes of imperfect ventilation which I shall mention are, 3rd, the injudicious construction of dwelling apartments and workshops, in consequence of which a renewal of the air is rendered as impracticable as in the blind alleys above referred to, and from the same cause, namely, the absence of two openings, one for the entrance, and the other for the exit of air;

And 4th, the ignorance and apathy which prevent persons from availing themselves of the facilities for ventilation, when such happen to exist.

As regards the former cause, many striking facts are contained in the reports of the Health of Towns Commission, which shew the great amount of illness, and consequent expense inflicted upon working men, by their employers neglecting the simple precautions necessary for the purification of the atmosphere of their work rooms. This disregard, by the masters, of the value of life and health to those in their service is seen to prevail to the greatest extent in small manufactories, the conductors of which are

generally men of limited capital. It is moreover constantly witnessed in the rooms used as work shops by tailors, shoemakers, and other persons engaged in sedentary occupations. The doors and windows opening into these rooms are kept closed, the air is heated by fires and gas lights, and, in the words of Dr. Guy, "the consequence is that the workmen are exposed at the same time to a high temperature and a foul and stagnant atmosphere." The habit of warming manufactories or work rooms by stoves, steam, and hot air, instead of by open fires, tends still further to increase the evil, by doing away with fire places, which are often the only passages for the escape of vitiated air. Persons engaged in business which requires their presence in shops or offices for several hours each day, also frequently suffer very much from the impurity of the air which they respire. In illustration of this point, Dr. Guy mentions, as the result of statistical enquiries, that the tradesmen of London are nearly twice as liable to consumption as the gentry, and attributes the extensive prevalence of this fatal disease among tradesmen and shopmen chiefly to the state of the shops, "which rooms (he adds) are often not larger nor better ventilated than those of the poor." The other cause of imperfect ventilation, that constituted by the ignorance or indifference of persons, who do possess the means of renewing the air in their apartments, is also frequently encountered. And in this town, where large fires are constantly maintained in the rooms occupied by poor families, and where the windows do

open, no advantage is taken of these circumstances to expel the offensive vapours generated by half-a-dozen individuals, two-thirds of whom are scarcely ever absent.

The supply of fresh air being from one or more of these causes rendered insufficient for the healthy purposes of respiration, many injurious and fatal consequences are induced. Among the diseases which have been directly traced to this source may be mentioned typhus and other malignant or pestilential fevers, consumption and the different forms of scrofula, disordered digestion, and nervous complaints; whilst as a predisposing and aggravating cause of disease, its noxious influence extends throughout every variety of bodily affliction to which mankind are subject. Numerous passages in support of these statements might be quoted from the most celebrated medical writers, but I do not think it necessary to occupy your time with circumstantial proofs of a principle which has long been familiar to the medical profession, and the more intelligent of the public.

In addition, however, to its influence in generating disease, defective ventilation also materially contributes to its propagation. A certain degree of concentration *generally* appears to be necessary for, and invariably predisposes to, the occurrence of an attack of fever. Thus Dr. Arnott observes that "in a public infirmary (that of Edinburgh) when the number of cases of fever began to exceed a certain proportion of all the cases of disease in a ward, the fever

began to affect the nurses, who were constantly present, and therefore much exposed to the infection; and when the proportion became still greater, it affected also the students, who were less exposed than the nurses, but more than the physicians, and when increasing still further, it affected also the physicians." This happened when certain wards were occupied chiefly by fever patients, "but when such patients were scattered about, so as to dilute the poison, the attendants remained safe, as did also neighbouring patients in the beds about them, proving that dilution of the contagious poison, by scattering the patients, as well as the complete ventilation of a fever ward, affords safety."* I may add that at Guy's Hospital, in London, where a similar plan has for some years been pursued, experience has also fully confirmed these views. Fever cases are there admitted, distributed throughout the spacious and well ventilated wards, and allowed to run their course, without any instances having, to my knowledge occurred of other patients receiving the infection from them.

We may, in the next place, proceed to consider the manner in which defective ventilation proves so destructive to life, and this examination will be found to facilitate very much the study of the operation of the other causes of atmospheric impurity. It has previously been stated, that in the minute air cells of the lungs, carbonic acid gas and various

* Health of Towns Commission, 1st report, vol. I, p. 61.

subtle and noxious effluvia are continually escaping from the blood into the atmosphere, while the atmospheric air is itself as unintermittingly absorbed into the mass of circulating blood. Now if the supply of fresh air to the lungs be suspended, it is very evident that the noxious matters extricated from the blood will rapidly accumulate in the air respired, and be almost as rapidly reabsorbed into the system. The purification of the body by the discharge into the air of its pestilential and poisonous effluvia is thus completely arrested, and the chemico-vital properties of the blood being acted upon by the decomposing and disordering agencies thus brought into contact with it, the quality of that fluid becomes injuriously affected, and if death do not at once result, the seeds of those fatal and distressing diseases which committ such fearful havoc in this country, become ineradicably implanted in the constitution. Imperfect ventilation, therefore, compels each individual to administer to himself a slow poison.

But the atmosphere of large towns also contains many injurious substances derived from other sources than the pulmonary exhalations of its inhabitants. Some of these I shall now proceed to enumerate, and in order to prevent unnecessary repetition, may, in running over them, make a few remarks upon such as seem to call for particular notice.

The first circumstance which here claims our attention, is the accumulation of animal and vegetable refuse in the public streets, where it is slowly de-

composed, emitting, during this process, most offensive and noxious effluvia. The Commissioner's local report, after stating that private lanes, and even new streets are subject to no regular time for paving and cleansing, goes on to observe, "that the streets most densely populated by the humbler classes in Newcastle and the neighbouring towns, run along the banks of the river Tyne, at the bottom of a very steep ascent, which is crowded with dwellings and intersected with numerous lanes and alleys; that in many places in these streets the paving is very imperfect, and receives the accumulated liquid refuse discharged from the steep banks, which keeps them to a greater or less degree in a perpetual state of impurity and offence (the facilities for drainage, afforded by the declivity of the ground, being thus lost and the evils concentrated in one spot); that they are destitute of effective arrangements for drainage, sewerage, or cleansing, and that the outpourings of the chares, lanes, courts and alleys, are of the most offensive description, and pre-eminently contribute to the production of fever and other diseases." V. i. p. 20, 2nd report.

It is true that the chief thoroughfares are generally kept tolerably clean, but the narrow lanes and crowded courts, where this evil shews the greatest tendency to develope itself, are never touched by the scavenger. In many of these places, indeed, ashes and dirty water are systematically deposited within a few feet of the entrance into each house, and this, not only in those crowded parts of the old

town, where dirt and misery have existed for centuries, but in streets which have not been inhabited for more than 2 or 3 years. Nor is this filthy and unwholesome custom justly chargeable on the poor inhabitants of these localities. They urge, and with reason, that they have no accommodation, and that when any receptacles for these matters are provided, they are generally insufficient in size, and being soon filled, remain for weeks unemptied.

The next cause of atmospheric impurity which falls under our notice, is the want of proper drainage, on which, as regards this town, the Commissioners thus report in their general table. "No regulations for drainage, many new streets without sewers, stagnant waterpools, and open ditches; drainage very defective and under no controul."

Many of the older streets are, indeed, in this respect, quite as deficient as those of the unimproved continental cities. Open gutters in their centre, arranged without any regard to the inclination of the ground, abounding in deep holes, and frequently obstructed by deposits of mud, constitute the sole provision for the discharge of the offensive fluids constantly escaping from the adjacent dwellings. In the recently built districts to which reference has just been made, the state of things is still worse. For as the streets are neither paved, nor furnished with drains, nor swept, the decomposing substances become trodden into, and mixed with, the clayey soil, so as to form a putrifying mud, from which, under the influence of a summer sun, the most

deadly vapours are constantly eliminated. And in situations where subterranean drains do exist, their arrangement and shape are unfavourable to the rapid discharge of their contents, and the latter becoming stagnant in their interior, undergo decomposition, and give off a variety of noxious gases, which find a ready vent through the numerous drain or gully holes opening into the streets. The nature and extent of the evils thus induced will be best understood by reference to the following extract from Dr. Southwood Smith's evidence. "When the animal and vegetable matters contained in a drain are not regularly and completely washed away, they become stagnant, a deposit is regularly formed; the matters constituting this moist and semi-fluid deposit are placed under circumstances highly favourable to their decomposition; at regular distances along all the great thoroughfares, close to the pavement, and opposite the doors of dwelling houses, are placed gully-holes, most conveniently situated for the regular escape of the poison as it is formed. In this manner a drain may become at once a laboratory in which poison is generated on an immense scale, and a conduit by which it is effectually spread abroad; and the extent to which at present it is actually thus generated and carried forth, may be accurately measured by every inch of drain which is not regularly washed by a good stream of water." Dr. Smith adds that in some instances it has been found necessary either to trap or to remove gully-holes in the

vicinity of butchers shops, to avoid the injurious effects of the effluvia upon the meat.

And in illustration of the principle that an intimate connection exists between the facilities provided for the removal of refuse and the health and mortality of the district, I cannot adduce a more striking fact than that quoted by the Commissioners in their second report. In this instance, which occurred in Manchester, the amount of deaths in 20 streets was ascertained before and after their improvement, and it was found "that the deaths immediately subsequent to the drainage and paving of the streets were diminished more than 20 per annum out of every 110."—(p. 6. v. 1.)

In speaking of the injurious effects arising from the neglect of drainage, I have partly anticipated the consideration of a third evil, viz. the absence in the dwelling houses of the poor, of certain indispensable conveniences, as well as of pipes for the discharge of dirty water. The complaints of labouring men and their families on these heads, are very numerous and distressing. It is impossible to converse with them on the subject without hearing accounts of hardships and privations, the infliction of which no plea of economy can possibly justify. Women having families to wash, cook, and provide for, and occupying rooms on the third or fourth storey, are compelled to carry all their dirty water down two or three sets of dark, crooked stairs, in order to discharge it into the street. In some instances, advantage is taken of their proximity to the roof to pour

it into the rain-water pipes and the latter soon becoming choked by the deposit of solid mud, the offensive liquids overflow and trickle along the walls of the house, rendering them at once damp and pestilential. In one small square, entered through a court leading out of Silver Street, an ash heap occupies the centre, and this serves the purposes of a cess pool. And in other situations, the accommodation of the poor is even worse than this. The filthy state of every lane and bye street, moreover, shews the practical inutility of the laws now in existence against the commission of nuisances, whilst it must be evident that the rigid enforcement of those laws would, in the present state of things, be an act of intolerable persecution, and that the only effectual remedy for these disgusting evils is to do away with the necessity for their continuance.

The next source of the products of putrefaction, and, consequently, of disease, is the existence of slaughter houses and knackers yards in the interior of large towns. Within a hundred yards of this very spot, in a lane densely populated, animals are every week slaughtered, their blood and refuse allowed to fill the gutters, and thence discharge into the atmosphere the poisonous gases resulting from the decomposition. In a still more central part of the town, a similar evil was pointed out to the Government Commissioner by my friend, Dr. Cargill, in the following words. "The most intolerable, and perhaps, the most unhealthy nuisance of the many existing in Newcastle, is certainly one resulting

from a slaughter house situated in the very centre of the most fashionable part of the town. It is close to Grey Street: the nuisance consists in the presence of great quantities of animal matter, the offal of the beasts, closely heaped up in a narrow kind of ash pit, adjoining the slaughter house, and there left to putrify until the reservoir is full, and the liquid contents stream down the lane (High Friar Lane) and fill the air in the neighbourhood with an odour so fearful, that no words can express its effect. No case can more loudly call for the removal of all slaughter houses without the limits of the town." (2nd rep. v. 2. p. 44.)

It is calculated that one-third of the bulk of the animals slaughtered by the butchers, is useless as food, and is, therefore, either thrown away or employed in various unwholesome manufactures. By erecting a public slaughter house, at some little distance from the town, with a copious supply of water, and under a system of regular inspection, the necessity for the introduction into towns of useless animal matters would be completely obviated, and a very extensive and constant cause of disease be effectually removed.

Other sources of atmospheric impurity very nearly allied to that just considered are 1. the existence of large piggeries and common dunghills in densely populated districts, and 2ndly, the practice of intramural interment. On each of these evils we may say a few words.

Dr. Reid in his report on Newcastle thus speaks

of the enormous size of some of the public depots for refuse. "In one of these (he says) the accumulation increases at times, to 1000 or 2000 tons, which is removed only once or twice a year. In some of the private courts, I have noticed accumulations amounting occasionally to 20 or 30 tons, all in a state of putrefactive fermentation, and penetrating largely into some of the lower apartments of the dwellings which surround them." (p. 20.) And as if the percolation of this liquid into their houses were not a sufficient source of discomfort and disease, many of the inhabitants of these localities (which are chiefly situated about Pandon and Sandgate) add to the evil by keeping an immense number of pigs. In some cases, the window of the front room on the ground floor is placed immediately above and almost in contact with a large piggery. And as the cleansing and drainage of these places is never attended to, another is added to the already extensive list of miasmatic causes.

The other injurious custom, that of so placing the dead that their decay must necessarily, and for a considerable length of time, act as a source of affliction and disease to the living, has been most ably discussed and powerfully condemned by Messrs. Chadwick and Walker. Whoever has read the "Gatherings from Grave Yards," by the latter gentleman, and Mr. Chadwick's learned and conclusive report "On the Practice of Interment in Towns," cannot, I think, refuse their consent to the enactment of a law prohibiting the further continuance

of that revolting and unnecessary source of contagious poison.

The last cause of a vitiated atmosphere to which I shall allude is the existence of certain manufactories, from which acrid and offensive fumes are copiously discharged : and of these perhaps no town for its size possesses more than Newcastle. Alkali-works, soaperies, glue and Prussian blue manufactories, tanneries and lead-works, are the chief seats of the chemical operations whence these injurious vapours arise. And it will be seen that they constitute some of the most important manufactures of the district. Any rash or inconsiderate measures, which might tend to cramp the energy of their managers, or otherwise interfere with the development of these extensive sources of employment, are therefore to be deprecated ; at the same time that the public interest, which must ever be held paramount to private considerations, imperatively demands the diminution of this evil to the greatest practicable extent. And there is every reason to believe that by an effective system of drainage, by the introduction of a large supply of water at a cheap rate, so as to facilitate their frequent cleansing, and by the use of various chemical and mechanical contrivances, the ill effects now experienced from these causes might be materially remedied, without subjecting the manufacturers to much inconvenience or expense.

From the joint action of these different sources of putrefactive and other chemical changes, it will be seen that the atmosphere of this town is constantly

vitiated, and rendered unfit for respiration, by the presence in it of innumerable noxious vapours. Some of these, modern chemistry enables us to isolate and separately examine. It is thus found that sulphuretted hydrogen, one of the gases extricated during the slow decomposition of animal and vegetable substances, is so poisonous that a mixture of 1 part of it with 800 parts of atmospheric air will kill a dog; that air containing only $\frac{1}{1500}$ th part of it proves speedily fatal to small birds; that it is soluble in nearly one-third its bulk of water, (which solution is quite as poisonous as the gas itself,) and hence that its existence in the air must necessarily tend to pollute any water with which that air may come in contact. A striking instance of its poisonous action upon the human subject lately occurred at Clapham, and is thus described by Dr. Duncan:—"Twenty-three children, belonging to a boarding school at that place, were simultaneously attacked with violent irritation of the stomach and bowels, convulsive twitchings of the muscles, and excessive prostration of strength; and two of them died in about 24 hours. The symptoms were ascribed by the medical attendants to the inhalation of sulphuretted hydrogen from the contents of a foul cess pit, which had been scattered over a garden adjoining the children's play ground." The symptoms in these cases, I may remark, precisely resembled those of cholera, and Dr. Duncan proceeds with great justice to observe that "although these effluvia are breathed by the inhabitants of our courts and back streets in a

state of extreme dilution, we cannot suppose that they are on that account entirely harmless. What in a concentrated form is very deadly, must, in a diluted state, be injurious to health." (1st rep., vol. 1, p. 139.)

In addition to sulphuretted hydrogen, other gases scarcely less injurious, such as carburetted and phosphuretted hydrogen are at the same time extricated from decaying animal and vegetable matters. But besides these gases, which chemistry enables us to examine, there are undoubtedly generated from the same sources many poisonous agents infinitely more subtle in their nature, and even more inexplicable in their operation, than any aeriform substances which science has yet brought to light. The physical and chemical properties of these imperceptible effluvia are totally unknown to us, but we can detect their existence by the diseases which they occasion when brought in contact with a living body. To different forms of these noxious effluvia, probably modified in their action by admixture with those more familiar poisons, to which reference has been made, pathologists ascribe the plague, the cholera, the yellow fever, typhus, small pox, scarlet fever; in a word, all those constitutional diseases which are propagated through the medium of the atmosphere. In support of this general statement, I shall at present merely quote the opinion of Dr. Southwood Smith, for many years physician to the London Fever Hospital, as to the origin of typhus. But the same facts and arguments which conducted him to this

opinion, may be applied in support of a similar view of the causation of other contagious diseases. He says, "I conceive the immediate and direct cause of fever to be a poison generated by the decomposition of animal and vegetable matters." p. 19. A hot summer, such as that of last year, favours this decomposition, and, as might have been expected, the mortality from the diseases termed "zymotic," (those induced by the atmospheric impurities now under consideration,) has during this winter been very great. The deaths in the December quarter of the year 1846, were in the Newcastle district 888, while in the same quarter of the preceding year they amounted to no more than 434, being an increase of 454, or twice the usual number. Of these additional deaths, nearly 300 were from scarlatina alone; and most of the remainder from typhus and other contagious diseases. The annual report of the Registrar General for the year 1846 has not yet been published, so that we cannot at present tell with accuracy how many of the 1239 additional deaths, which occurred during the past year, are referable to zymotic causes; but we are, I think, fully justified in assuming that at least three-fourths of them arose from those atmospheric poisons which we have been engaged in considering. I cannot better conclude this brief and imperfect sketch of the causes of contagious disease, existing in the atmosphere of this and other large towns, than by reading a short extract from the last quarterly return of the Registrar General, who observes that "as the different families

of men are of one kind, and of one blood, they have diseases in common. Like living things, epidemics do not cease with the circumstances in which they are produced; they wander to other places, and descend to remoter times. The plagues of the eastern empire and 'the black death' depopulated the western world: the Egyptian ophthalmia blinded thousands in Europe: the camp or typhus fever, which broke out in the French army, after their disastrous retreat from Moscow, became contagious, and committed terrible ravages among the peaceful citizens of Poland, Prussia, Saxony, Germany, and France: the cholera epidemic, generated in the miserable population of Asia, on the banks of the Ganges, traversed England from Sunderland to London and the Land's End. If"—continues the writer—"all nations, however remote, are liable to suffer from each others maladies, and have therefore a direct interest in each others well-being, the principle holds with ten-fold force of the provinces of the same kingdom, and the inhabitants of the same cities." (P. 3.)

The *third* great necessary for the preservation of the cleanliness of towns, and the health of their inhabitants, is a plentiful supply of water. As an aliment, water holds the first place in the animal economy: without it, the operations of life soon languish, the vital functions speedily become disordered, and, if it be wholly inaccessible, many melancholy instances have shewn that death, preceded by dreadful sufferings, and ushered in by de-

lirium, will, in the course of a few days, inevitably result. In connection with the present subject, water may be regarded in a double point of view: as an article of food, for which purpose it must be free from any injurious ingredients; and, secondly, as an essential to cleanliness. For the former destination its quality, for the latter its quantity, is chiefly to be considered. As regards *quantity*, an unlimited supply could in this town be readily obtained from the river. And were proper measures taken to divert to other and more profitable ends the sewer-streams which now pollute it, the water of the Tyne might, after a little preparation, constitute a not unwholesome beverage. At present its quality renders it unfit for general use; but however bad it may be in this respect, thousands of the poorer inhabitants would feel grateful were it accessible in their houses. The toil and suffering inflicted upon the poor, by the present defective arrangements, are so great as to have attracted the notice of strangers. Lord Ebrington, in a lecture on the unhealthiness of towns, delivered in the Mechanics' Institute at Plymouth, when speaking of the imperfect supply of water to large towns, says "the waste of labour thus occasioned is enormous. I need do no more than mention the long strings of people waiting round the pumps at Newcastle." And in illustration of the same point, I may be allowed to relate one fact which recently fell under my own notice. A labouring man's wife, occupying a room in the upper part of one of the new streets which terminate near the

top of Arthur's Hill, is in the habit of adding to her husband's earnings by taking in washing. Now to obtain the water necessary for this and common domestic purposes she is compelled to walk to Gallowgate, a distance of about a quarter of a mile, and after buying it by the pailful at the pant there, must add to her other labour the toil of carrying it up the hill, along roads which are often almost impassable. With such facts as these before us, who can blame the poor for the dirtiness of their houses and persons? Were a constant supply of water to each house rendered by law imperative on the landlord, the tenant paying for the convenience, which it is estimated would not cost 1*d.* per week, such instances as that now alluded to could not occur, and in no other manner can the prevention of these evils be secured.* If a calculation were made of the labour and loss of time endured by the poor of this town, in obtaining their present imperfect supply of water, (for which they pay an extravagant price,) it would, at the ordinary rate of calculation, exhibit an immense tax upon those who can least afford any unnecessary encroachment upon their means. The report of the Health of Towns Commission states the supply in Newcastle to be "of very indifferent quality, costly to the poor, and not sufficient in quantity for the wants of the population;" and that "in this as in all the other towns visited in the northern

* At the time of the Commissioner's visit, it appeared that out of 15000 houses in this town only 1350 were so supplied with water.

district, there was abundant evidence of the want of a proper supply for the health and comfort of the labouring classes, though the more wealthy inhabitants enjoyed a much better supply, and paid much less for what they consumed." The report then proceeds to allude to the project for supplying the town from Whittle Dean, which is stated to afford pure water in sufficient quantity, and at a pressure sufficient to raise it above the highest houses. This latter is another great desideratum in arranging the supply of a town with water, as it furnishes a constant and efficient means of suppressing fires, and so tends to diminish the expense of insurance. I have before had occasion to observe that water possesses the property of dissolving the various poisonous effluvia derived from drains, gas pipes, &c. Wherever, therefore, these effluvia exist in considerable quantity, the water in contact with them cannot be wholesome; and, if time permitted, many facts might be adduced to prove this. The importance of a copious supply of water for the purposes of cleanliness is so obvious as scarcely to require comment. Were baths in more frequent use, we should not meet with so many skin diseases among the poor; and for the cleansing of sewers, market places, slaughter houses, &c., large streams of water are equally indispensable.

Bodily exercise, another essential to health, proves beneficial by throwing the respiratory organs into a state of activity, and by promoting the equal distribution of the blood throughout the differ-

ent parts of the body. The ill effects of constrained attitudes, and of sedentary habits upon the constitutions of children, have long been familiar to medical men. They have even directly traced disease and death to the imperfect developement of the lungs consequent on the want of muscular exertions in the child. In large towns children are nevertheless allowed to grow up without any attention to this important point, either by their parents through ignorance, or by the public authorities, through apathy. And the consequence is, that town bred children are in general, a puny, debilitated progeny. Their homes have no gardens or fields attached to them, their schools are void of play grounds, they are given to understand that healthful exercises are idle sports, rather reprehensible than to be encouraged, and the want of opportunity gradually inducing the want of inclination, the young men of towns are insensibly led to result to other less innocent sources of gratification.

The last great object required for the preservation of health and life, is an adequate supply of wholesome food. With the quantity furnished for public use, we have at present nothing to do, but the quality is a point scarcely inferior in importance. If meat be even on the verge of putrefactive change, it not only ceases to be a source of strength to the system, but at once becomes an active and powerful poison. Innumerable facts, too numerous indeed to be here mentioned, prove most indisputably the poisonous influence of unsound animal and

vegetable articles of diet, and, therefore, constitute so many arguments for the prevention, as far as possible, of such unwholesome food being supplied to the public.

This, then, completes a brief review of those sources of disease which are capable of being either removed or materially diminished in amount, by legislative interference. And in accordance with the plan on which this lecture is arranged, I shall now proceed to trace in a few words, the moral, intellectual, and social evils which originate from those causes, and conclude by noticing, in a cursory manner, the means which appear best calculated to effect their removal.

There unfortunately prevails, among many unreflecting individuals in the higher classes of society, a very erroneous and ungenerous opinion, that a certain degree of connection naturally exists between crime and poverty: and that as the latter is, particularly in large towns, almost invariably accompanied by a want of personal cleanliness, and frequently by coarse and indelicate habits, it necessarily tends to lower the tone of morality, and so gradually prepares the way for vice. Now that any circumstances which have the effect of *necessitating uncleanness and inducing an habitual disregard of all natural feelings of delicacy* will ultimately brutalize the dispositions of the individuals so unhappily situated, I am not prepared to deny. But I must confess my inability to perceive, either in the laws of nature, or in the revelations of reli-

gion, any reasons why poverty should so entail upon its victims the still more grievous burden of infamy and sin. Up to the present moment, indeed, and under the apathetic system of legislation which has hitherto prevailed, poverty *has been* disproportionately connected with crime: but why? Are the poor, as a body, ignorant, are they irreligious, are a large number of them dissipated, depraved, drunken, dangerous, who is to blame? Are many of them deaf to the voice of reason, and some hardened even against the promptings of natural affection, on whom does the responsibility rest before God and man? On themselves? Born in physical darkness, nurtured in an atmosphere unillumined by the rays of wisdom, or the pure light of religion, continuing throughout youth ignorant of their moral duties, unprovided by education with those intellectual resources which tend to divert the mind from grosser pleasures, urged by necessities, and exposed to temptations unknown to the more fortunate of their race, they reach maturity, children as regards everything that is good, skilled but in evil. Have *the rich* nothing to do with those horrible revelations which have recently taken place in Lancashire and other districts, where mothers, for the sake of obtaining a little money, and to be relieved of the burden, have systematically poisoned their own offspring; where children of both sexes habitually resort to midnight scenes of debauchery and excess; where intemperance and crime, pestilence and ruffianism flourish as rank weeds in the neglected soil of fallen

humanity? Or if still loath to carry out, in respect to their own poor, the precepts of Him who declared that "to whomsoever much is given, of them shall much be required," are *they* prepared for that fearful catastrophe alluded to by the Rev. Mr. Clay when he observes that "unless the great mass, yet chaotic, be, by God's blessing, breathed upon by the spirit of intelligence and of religion, it may be hurled upon all that is fair and good among us with a momentum as sudden as it is irresistible?"

I shall not pollute your ears, nor pain your feelings by detailing, in the words of eye witnesses, the scenes of vice and immorality, which may be, in a great measure, ascribed to the same causes as the various physical evils already considered, viz. overcrowding, and the want of accommodation and comforts in the dwellings of the poor. It may suffice to give in his own words the opinion entertained on this point by one who has devoted more time and labour than any man living to the amelioration of the condition of the poor of this country. "A clean, fresh, and well ordered house," says Dr. Southwood Smith, "exercises over its inmates a moral, no less than a physical influence, and has a direct tendency to make the members of the family sober, peaceable, and considerate of the feelings and happiness of each other. Nor is it difficult to trace a connection between habitual feelings of this sort, and the formation of habits of respect for property, for the laws in general, and even for those higher duties and obligations, the observance of which no laws can en-

force. Whereas a filthy, squalid, unwholesome dwelling, in which none of the decencies common to society, even in the lowest stage of civilization, are or can be observed, tends directly to make every dweller in such a hovel regardless of the feelings and happiness of others, selfish and sensual; and the connection is obvious between the constant indulgence of appetites and passions of this class, and the formation of habits of idleness, dishonesty, debauchery, and violence, in a word the training to every kind and degree of brutality and ruffianism." (1st Rep. v. i. p. 29.)

If then the absence of physical comforts has operated thus powerfully in debasing the moral nature of the poor, it will need but little reflection and few arguments to prove that their *intellectual* development is, under existing circumstances, almost an impossibility. It is in vain to provide schools for children, while their homes are so dark as to prevent them from continuing their studies by their own firesides. Nor will they ever be taught to appreciate the beauty of literature, or the power of wisdom, until they have acquired sufficient intelligence and self respect to recognize the advantage of personal cleanliness and domestic comfort.

The *social* evils resulting from the combined influence of the physical, moral, and intellectual degeneracy of so large a proportion of the population of this kingdom, are so numerous and extensive that anything like a complete review of them in the limited duration of a lecture is clearly impracticable.

I shall, therefore, merely enumerate some of the chief injuries inflicted on the state, on society at large, and on the individuals contributing towards the maintenance and relief of the poor, by the absence of public sanitary arrangements. And through the kindness of Mr. Chadwick, I am enabled to illustrate some of these points by reference to local statistics.

The first evil to which I shall allude is the substitution of a young and feeble, for a mature and vigorous population. In explanation of the extent to which this source of national weakness results from preventible causes of disease, such as those which induce fever, Dr. Southwood Smith states that "by far the greatest number of persons attacked by that disease are between the ages of 20 and 30, and that the mortality from the attack increases with the advance of years, so that the risk of life from this malady at the age of 31 is just double the risk at the age of 11." The connection between the operation of this distressing law, and the production of widowhood and orphanage—the two chief sources of pauperism—is self evident, and even in a political point of view the physical deterioration of our labouring population has become so great as to render it very difficult for the recruiting officers to obtain a sufficient number of healthy men for the supply of the army.

Another circumstance, which in a happier state of society might have been regarded as a blessing, but which, as adding to the amount of crime

and suffering, cannot in the present unhappy condition of many of our large towns be considered in any other than a melancholy light, is the tendency of a town population to increase at a more rapid rate than the inhabitants of country districts. The statistical table, contained in the appendix, exhibits very clearly the operation of this law in our own locality. Thus the proportion of births to the population of 1841 (when the last census was taken) is

	For the Newcastle district.	For the Morpeth district.
in 1840	1 in 27	1 in 38
1841	1 in 29	1 in 37

And a following table explains very satisfactorily the chief cause of this unequal rate of increase. For it appears, from a similar method of calculation, that the marriages in

	The Newcastle district.	The Morpeth district.
in 1840	1 in 60	1 in 303
1841	1 in 64	1 in 279

shewing that the tendency to marriage is in Newcastle nearly five times greater than in the agricultural districts of this county. Many of these marriages take place at a very early age, being of course very improvident; and, as indicative of a recklessness of disposition similar to that which has mainly contributed to pauperize Ireland, this tendency has naturally excited some uneasiness in persons concerned for the future welfare of their country. It may, moreover, be questioned whether the hap-

piness of working men and their families would not in general be more effectually secured by deferring marriage till they have accumulated a reserve fund against the day of sickness, of inaction, or of death, than by incurring, at the very commencement of their receipt of wages, the heavy and increasing responsibility and expense of a family?

We may, in the next place, proceed to estimate the extent to which the noxious agents previously considered injuriously affect the inhabitants of this town. These causes of disease are, it must be remembered, wholly preventible; and as the mortality for the last year was unusually great, I shall continue to use the calculations based upon the mortality in 1841. The first point to be noticed is the comparative rate of infantile mortality in different districts in this county. And we find that whilst only 1 child in twelve died under one year of age in the Morpeth district, in Newcastle 1 out of every 5 infants perished within the first twelve months of existence. The importance of this disproportionate mortality arises from the fact of "children being the most susceptible to atmospheric influences, and the rate of mortality amongst this class being the least affected by migration and immigration, and not at all affected as the adult classes are by the physical circumstances attendant on their occupations."

Another consequence directly referable to the neglected state of this town is the large proportion which the number of persons annually killed by epidemic diseases bears to the whole population.

Thus in Newcastle, during the year 1841, 1 inhabitant out of every 150 died from this cause; whilst in the northern district of the county the proportion was but as 1 to 334. And during the past year, the deaths thus occasioned must, in this town, have amounted to nearly 2 per cent. of the whole population. For I find that out of the 2104 deaths which took place in the former comparatively healthy year, no less than 480, or nearly one-fourth, were from contagious diseases; and from the extensive prevalence of scarlatina and typhus during 1846, the proportion must then have been considerably higher. The mortality from diseases of the respiratory organs, including consumption, is also found to be twice as great in Newcastle as in the country districts; and this, notwithstanding a vast amount of preventible disease, is, in the latter, also occasioned by the neglected and unwholesome state of the dwellings of the labouring population.

From these facts it will be readily understood that the average duration of life is much less in the town than in the country district. The average age of *all* who died in Morpeth, &c., during the year 1841 was 39 years and 5 months, whilst in Newcastle it amounted to no more than 24 years 2 months, being a difference of 15 years and 3 months. This then represents the years of life which may be considered as lost to every individual born in this town. And if we limit the examination to a comparison of the average age of all who have died in the town and country districts above the age of 20, (and conse-

quently contributors to the general wealth of the country), the loss of life to the inhabitants of this town will appear equally striking. This loss, calculated on the mortality of 1841, amounted to 6 years and 8 months of the most valuable part of life; and estimating the value of this time at the low rate of 7*s.* 6*d.* per week, male and female, it represents a sum of £130. lost to the family of each individual thus prematurely cut off. The excess of deaths of adults in Newcastle, as compared with the proportionate mortality in the Morpeth district, was, in 1841, 125; which, being multiplied by £130., the sum lost in each individual death, shews an annual loss (chiefly to the families of labouring men) of £16,250. But as the lowest rate of mortality, even in the healthy districts of this county is yet much higher than classes in good physical circumstances are known to attain, (the members of the Society of Friends averaging upwards of 52 years for all born, whilst the average duration of life in the Morpeth district is no more than 39½ years) Mr. Chadwick includes the whole of the additional deaths in his estimate of the pecuniary loss to Newcastle, from preventible disease. And the £130 lost with each individual being in this case multiplied by 886, the excess on the whole of the deaths, gives the enormous sum of £115,180 as the ultimate loss to Newcastle in respect to profitable labour annihilated by unnecessary and avoidable disease.

Another item of loss arises from the money laid out for the funeral and other expenses of the indi-

viduals thus destroyed. This expense is estimated at £5. per death, and shews on the total number, 886, an annual loss of £4,430. “ But beyond this it is found that for every death in excess, there has been at the least, twenty-eight cases of sickness in excess, the expense of which cannot be less than £1 per case,” and this consequently exhibits a still further loss of £24,808, making the total loss to Newcastle, on the year’s deaths, (constituted by the three items of funeral expenses, preventible sickness, and loss of productive labour,) amount to £144,418. And if to this we add £11,700, the sum considered by the Rev. Mr. Clay to be annually extorted by the smoke nuisance, it will increase the estimate of the annual loss to this town, occasioned by the neglect of sanitary measures, to £156,118.

But in addition to the *indirect* saving which the adoption of those measures would accomplish, a very valuable source of income is now lost to the governing bodies of our towns by the discharge of sewer streams into rivers. It has been calculated that the annual value of this fluid, as a manure, is at least £1 per head of the population: in Belgium, they estimate it at £1 17s. To render this intelligible, it may be necessary to explain that the sewer water contains in large quantities the phosphates of lime and ammonia, and the various nitrogenized substances which render guano, bone-earth, and other comparatively expensive articles so valuable for agricultural purposes. This will be at once understood by a glance at the two following tables,

which I extract from a lecture by Dr. Guy, "on the application of the refuse of towns to agricultural purposes."

The first table shows the quantities of the several constituents of plants contained in the water discharged by the river Medlock, at Manchester, on the 2nd of October, 1845, that day being regarded as a fair average. The analysis is by Dr. R. Smith.

	Per diem.	Per annum.
Potass,	178 cwt.	3,200 tons.
Soda,	257 „	4,640 „
Lime,	940 „	16,900 „
Magnesia,	9 „	160 „
Phosphoric acid,	71 „	1,280 „
Silica (in solution),	266 „	4,800 „
Alumina (ditto),	18 „	320 „
Oxide of iron,	124 „	2,240 „
Sulphuric acid,	444 „	8,000 „
Chlorine,	151 „	2,720 „
Organic matter,	1,355 „	
Containing 6 per cent. of Nitro- gen, or	80 „	1,440 „
Insoluble matter, chiefly silica, alu- mina, and iron,	1,860 „	33,600 „

The other table shows the quantities of these substances carried away from 50 acres of wheat and barley and 50 acres of green crops.

Potass and soda,	780 lbs.
Lime and magnesia,	948 „
Phosphoric acid,	1549 „
Silica,	450 „
Metallic oxides,	8 „
Sulphur and Chlorine,	21 „
Nitrogen,	2681 „

From the elevation of the district surrounding Newcastle, there would probably be some difficulty in applying this fertilizing substance in a liquid form, as proposed at London, Manchester, and elsewhere. Assuming, therefore, its value to be somewhat diminished by this circumstance, and reducing the estimate to one-fourth of the usual amount, it would, nevertheless, at 5s. per head, of a population of 80,000, furnish a yearly revenue of £20,000 to be applied to the sanitary improvement of the town. This sum, therefore, still remains to be added to the estimate of the loss annually inflicted on Newcastle by the absence of sanitary precautions, which will then amount to no less than £176,118. We might even go further, and shew that the removal of many of the preventible causes of disease will also have the effect of diminishing crime, and so reducing the expenses now incurred in the prosecution of criminals, and observance of precautionary measures. I shall, however, content myself with quoting a passage on this point from Lord Ebrington's lecture, in which a direct allusion is made to the large proportion of criminal population contained in this town.

“The sick and the criminal,” says the noble lecturer, “have to be supported, themselves with their families, out of the property of the country. The criminal inflicts a heavy expense upon society besides, in precautionary measures, such as police; in loss and waste, such as robbery and arson; in prosecution and subsequent punishment (except in the case of public executions, or whipping, which though not directly expensive, exhibit to the people a brutal and brutalizing spectacle, and excite sympathy rather than terror in the beholders). It was calculated the expense and loss to the town of Liverpool, (with a population of 220,000,) arising from the vice and crime of 4700 vicious characters residing there, was £700,000 a-year: a statistical society there, thinking this calculation was exorbitant, went carefully over it, and pronounced that it was under rather than over the mark. The number of depredators, offenders, and suspected persons in Liverpool is 1 in 45; in Bath 1 in 37; in Bristol 1 in 31; in *Newcastle-upon-Tyne* 1 in 27. In all these the mortality among the poorer classes is very great. We have seen, to use Mr. Clay’s words, that dirt, disease, and crime are concurrent; so we may reasonably assume that sanitary measures, though insufficient of themselves to cope with the depravity of the human heart, will, as far as they go, tend to improve it.” (P. 17.)

The length to which these remarks have extended, renders it impossible for me to attempt more than a mere enumeration of the remedies for the evils which we have had under consideration.

They are,

1. The total abolition, or if that cannot be effected, an equitable adjustment, of the window tax; so that it shall no longer press with unequal severity upon the poor inhabitants of tenemented houses.
2. The erection of dwellings, in which poor families may be accommodated at a reasonable rent, with at least *two rooms*, this being indispensable for the preservation of natural delicacy.
3. The establishment in populous districts, of wash-houses, baths, bake-houses, and soup-kitchens, all of which could be conveniently and economically arranged under one roof.
4. The general distribution of an increased supply of water at a cheap rate. This is the remedy which of all others is most urgently required, and to obtain its full benefit, the supply of water should be accessible in the interior of *every* house, be constantly maintained at a high pressure, and be so arranged as to facilitate the introduction of water closets into the dwellings of the poor.
5. An extended and efficient system of drainage: this would imply
 1. The existence of waste pipes in every house, and of draining tubes or sewers in every street.
 2. The prevention, by valves and other contrivances, of any communication between

the interior of the sewers and the atmosphere of the streets.

3. The collection and distribution of these refuse matters, so as to secure the pecuniary advantages resulting from their applicability to agricultural uses.
6. The consolidation, under one general authority, of the powers now granted to different companies for the supply of each town with water, its paving, drainage, cleansing, &c.; and the extension of the jurisdiction of this general board over the populous districts adjacent to, but beyond the boundaries of each borough.
7. The regular and frequent cleansing, under proper inspection, not only of the main streets, but also, and still more frequently, of the narrow and filthy lanes inhabited by the poor, as well as of all those manufactories and places where animal and vegetable matters are apt to accumulate.
8. The prohibition of slaughter houses, piggeries, extensive manure heaps, &c., and the discouragement of the practice of interment within the precincts of the town.
9. The promotion of the ventilation of workshops, public buildings, and private dwellings, by explaining the operation, and otherwise facilitating the introduction, of cheap and effective contrivances for that purpose.
10. The encouragement, in every possible man-

ner, of habits of personal and domestic cleanliness amongst the poor.

And lastly. The diversion of labouring men and their families from demoralizing habits, by providing them with more healthful and elevating sources of amusement than those to which they now have access. This object would be effected by the encouragement, under proper restrictions, of athletic sports and exercises, the establishment of free or cheap reading rooms, the formation of public walks, or botanical and zoological gardens, where music might occasionally attend, at the public expense, for the gratification of the poor.

It is only by simple means like these, by treating them with kindness and consideration, and by so improving their physical condition, as to render their homes healthy, happy, and comfortable, that any considerable progress can be made towards effecting the mental and moral amelioration of the labouring classes of this country. Such is the conclusion arrived at by many of the best and wisest amongst us, men who like Lord Ashley, have devoted their lives to the cause of humanity, and it is one, moreover, fully borne out by all missionary experience. It is thus, in the first instance, found of comparatively little avail to talk to heathen nations about the Gospel and Christianity ; but after their lives have been saved, their fields rendered more productive, and their comforts increased through the efforts of their foreign friends, they

naturally listen with attention to the counsels, and receive with enthusiasm the precepts, emanating from the same quarter. And even so will it be with the great mass of the poor of this kingdom. Let *them* once experience the blessings of health, of cleanliness, and of decency, let *them* once feel that these and other legitimate sources of happiness have been obtained through the exertions of their more intelligent and powerful neighbours, and sceptical indeed must be the man who can imagine that *they* will not prove as grateful for kindness, as attached to those who have served them, and as zealous for their own progressive improvement, as the so-called savages of Polynesia.

I have now, I fear, trespassed to an unreasonable extent upon the time of those who have honoured me with their attendance this evening; my concluding remarks shall, however, be brief. From even the present cursory review of the subject, it is evidently one the interest of which is not confined to any particular profession or class. In the words of the London Health of Towns Association, "rightly understood it is the interest of every man, woman, and child, of every rank and station, to secure a good sanitary bill. It is the interest of the rich, who are constantly falling victims to diseases bred in the filthy and neglected habitations of the poor; it is the interest of the rate-payer, who is heavily taxed by unwholesome dwellings and workshops; it is the interest of the charitable, who feel that all they can give is miserably inadequate even to the palliation

of evils which might have been prevented; it is the interest of the landlord, whose rent is always better paid by a healthy than by an unhealthy tenantry, and whose property is raised in value by every structural arrangement which conduces to health; it is the interest, above all, of the labouring poor, to whom health is but a synonyme for wealth, and sickness and premature death, for poverty, embarrassment, and destitution."

But laying aside all considerations of interest, we may take higher ground, and say that it is equally the duty of the patriot, who desires to see his country great, prosperous, and powerful, and of the Christian, who seeks to extend the humanizing influence of his religion, to contribute by every means in their power towards the completion of the great work now in progress. To this course they are indeed invited by the principles of enlightened statesmanship, not less than by the dictates of philanthropy. The territory of England may at this moment be unbounded, her merchants may be princes, and her rulers among the mighty of the earth; she may boast of the triumphs of her arms, and glory in the grandeur of her achievements, but does she not, in the conflicting interests and hostile classes existing within her own bosom, present many evidences of impending decay? And how can her greatness be more effectually preserved and perpetuated than by the enactment of measures, having for their object the more intimate union of those hitherto antagonistic sections, into which the social fabric has been so long and so un-

happily divided? The introduction of those measures will be undertaken by the Government; but their practical operation may be very much facilitated by the diffusion of information, and the removal of prejudices on the subject, through the efforts of individuals, or of associations: of the latter two kinds are in existence in London, and other large towns; one formed of the more wealthy and educated classes, the other mainly composed of working men themselves. Both are pre-eminently useful: and it is to be hoped that similar associations will soon make their appearance in every populous town throughout the kingdom. It only remains for me, in conclusion, to express a sincere conviction that the inhabitants of Newcastle will not be behind the other great commercial and manufacturing communities, in the hearty adoption of those salutary enactments which, whilst adding to the safety and comfort of every class of society, and conferring many immediate blessings upon the poor, must, at the same time, dispose the latter to receive with thankfulness, and observe with zeal, many of the suggestions of those interested in their moral and intellectual regeneration.

PREVENTIBLE EXCESS OF SICKNESS AND MORTALITY, AND CONSEQUENT PECUNIARY EXPENSE CREATED BY THE WANT OF DRAINAGE AND OTHER SANITARY MEASURES IN THE COUNTY OF NORTHUMBERLAND.

EXPLANATORY OBSERVATION.—The following view of the Rates of births and deaths amongst the populations of differently conditioned Districts in the County of Northumberland is made up from the Returns to the Registrar General, during the year 1841, estimated in the several modes used by Mr. Chadwick in the Sanitary Report. One of the chief of these is the comparative Rates of Infantile Mortality in different districts, as shewn in the proportion of deaths of children under 1 year, to the births of children (Column 6); children being the most susceptible to atmospheric influences, and the rate of mortality amongst this class being the least affected by migration and immigration, and not at all affected as the adult classes are by the physical circumstances attendant on their occupations. 2ndly.—Proportions of deaths from epidemic diseases (Column 7). In well drained, well cleansed, and well ventilated Public Establishments, Typhus and other similar diseases, are rarely found to arise, and when they do arise, are seldomer fatal. The great mass of this class of deaths are proved to be preventible. The health of populations in well drained, well cleansed Town Districts have, in particular instances, been increased beyond the average of Rural Districts, and, it is possible that all may be greatly advanced. The lowest rate of mortality found in the Districts of which an account is given beneath, is yet much higher than classes in good physical circumstances are known to attain, namely, of the Society of Friends upwards of 52 years for all born. The pecuniary consequences of the preventible excess of deaths, are set down as an average expense of at least £5. for each funeral; but beyond this, it is found that for every death in excess, there has been at the least twenty-eight cases of sickness in excess, the expense of which cannot be less than £1. per case; and female, which for all classes, skilled and unskilled labourers, will be a low average loss beyond the prime cost of their maintenance. It has been demonstrated as a general law in the Sanitary Report, that amidst large masses of people the ravages created by an excessive mortality, are more than made up by an excess of births, and that pestilence, instead of diminishing, rather increases the numbers of the population. It has also been proved, and is now matter of extending experience that in the Rural Districts the defective drainage and stagnant moisture, which give rise to epidemics amongst men, give rise also to epidemics among stock, and diminish at the same time the amount of vegetable production to maintain them. The more the facts are examined, the more it will be found that there is no larger economy than in well directed sanitary means of prevention, and that the pecuniary losses hereunder set forth as resulting from preventible causes of disease are greatly under estimated.

Excess beyond the loss of life experienced at Morpeth, &c. preventible in each District.

Registration Districts.	Total number of deaths in each district during the year 1841.	Total number of births in each district during the year 1841.	Proportion of deaths in 1841 to the population in each district.	Proportion of births in 1841 to the population in each district.	Proportion of deaths of infants under 1 year to the births in 1841.	Proportion of deaths from epidemics in each district in 1841 to population.	Average age of all who have died in each district.	Average age of all who have died above 20 years.	Excess in No. of			Years loss of life to		Total loss of money value of productive labour at 10s. per week men, and 5s. per week women, say, 7s. 6d. per week to each Adult individual.	Total loss on the year's deaths in				Approximate proportion of life lost by each person.
									All deaths.	Deaths of Adults.	Births.	Every individual.	Every Adult.		Sickness.	Funerals.	Labour.	Total.	
Population.			1 in	1 in	1 in	1 in	yrs. mos.	yrs. mos.				yrs. mo.	yrs. mos.	£.	£.	£.	£.	£.	
Morpeth, Rothbury, Alnwick and Belford, }	47481	802	1289	59	37	12	334	39... 5 59... 11	...	...	...	...	...	...	...	...	...	...	...
Berwick on Tweed,.....	20938	378	678	55	31	10	269	38... 6 61... 7	24	6	110	0... 11	...	...	672	120	...	792	1-13th
Glendale, Bellingham, and Haltwhistle, }	27628	405	864	68	32	12	406	34... 1 56... 7	...	...	114	5... 4	3... 4	65	...	...	14820	14820	1-7th
Castle Ward and Hexham,....	42466	842	1307	50	32	9	383	33... 11 56... 0	125	32	154	5... 6	3... 11	76	3500	625	36556	40681	1-7th
Tynemouth,.....	55625	1340	2181	42	26	7	293	28... 5 54... 7	398	58	671	11... 0	5... 4	104	11144	1990	67184	80318	2-7ths
Newcastle on Tyne,.....	71850	2104	2490	34	29	5	150	24... 2 53... 3	886	125	539	15... 3	6... 8	130	24808	4430	115180	144418	2-5ths
Total, ...	265988																		
Total,.....	5871	8809	...	...	...	...	...	...	1433	221	1588	...	...	...	40124	7165	233740	281029	...
Average,....	...	...	...	45	30	7	250	30... 3 56... 0	...	...	...	9... 2	3... 11	76	...	...	...	...	2-9ths

Districts.			
Total No. of adults prematurely dying, Do	Newcastle	{ ...501 or to every 10 000 of the population	70
	Morpeth, &c.	{ ...226	48
No. of all classes killed by epidemic, endemic, and contagious diseases, }	Newcastle	{ ...480	67
	Morpeth, &c.	{ ...142	29
Deaths of all classes, from diseases of the respiratory organs }	Newcastle	{ ...540	75
	Morpeth, &c.	{ ...164	35

		Newcastle district.	Morpeth &c. district.
Proportion of deaths to the population of 1841	1839.....	1 in 34.....	1 in 70
	1840.....	1 in 35.....	1 in 63
	1841.....	1 in 34.....	1 in 59
Proportion of births to the population of 1841	1839.....	1 in —.....	1 in —
	1840.....	1 in 27.....	1 in 38
	1841.....	1 in 29.....	1 in 37
Proportion of marriages to the population of 1841	1839.....	1 in —.....	1 in —
	1840.....	1 in 60.....	1 in 303
	1841.....	1 in 64.....	1 in 279

APPENDIX.

NOTE 1. " Among the many communications made to me on subject (says Dr. Reid, in his local report) I may quote more particularly the following extract from Mr. George Richardson, of Newcastle. He states that ' no circumstance has contributed more to injure the habitations of the poor, and to diminish their healthiness, than the tax upon windows, the manner of its assessment, the high duty upon window-glass. During the long war, each window above ten was subject to an additional duty of 15s. * *

* * In cases where one family only occupied a house, this criterion of ability might, perhaps, be a pretty sound one ; but it wholly fails in the case of large houses let in tenements to the poor.

* * This heavy taxation naturally induced proprietors of such property to close up every window not absolutely necessary for light ; many of the stair-cases were so darkened that it became necessary to grope the way up them at noon-day as at night. The effect of this process upon ventilation was deplorable, and continues to operate to this day ; for although the tax upon windows has been considerably reduced, yet it falls heavily upon such houses."